Short Form Manual

IEC-625/IEEE-488 Interface

Dual Channel Signal Analyzer Type 2032

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DUAL CHANNEL SIGNAL ANALYZER
TYPE 2032

IEC/IEEE INTERFACE

July 1983

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1. INTRODUCTION

The following chapters give a summary of the logic functions of the 2032 IEC-625/IEEE-488 interface. Only the most important specifications are described. For complete details, refer to the 2032 main Interface Manual.

Chapter 2 deals with general programming, while Chapter 3 describes how the individual JOBs are used in the control of data flow between the 2032 and an interface controller. The error messages which can occur during a data transfer are listed in Chapter 4.

2. GENERAL PROGRAMMING

2.1. ADDRESS SWITCH

The 2032 IEC/IEEE interface address is set using the ADDRESS switch on the rear panel of the instrument. The possible address settings are listed in Table 2.1. The address setting can be displayed on the 2032 Display in the lowest selectable field (Fig. 2.1), but can only be changed via the ADDRESS switch itself.

ASCII Address Characters		ADDRESS SWITCH					Address Code	
Listen	Talk	A5	A4	A3	A2	A1	decimal	octal
SP	@	0	0	0	0	0	0	0
!	A	0	0	0	0	1	1	1
"	B	0	0	0	1	0	2	2
#	C	0	0	0	1	1	3	3
$	D	0	0	1	0	0	4	4
%	E	0	0	1	0	1	5	5
&	F	0	0	1	1	0	6	6
'	G	0	0	1	1	1	7	7
(	H	0	1	0	0	0	8	10
)	I	0	1	0	0	1	9	11
*	J	0	1	0	1	0	10	12
+	K	0	1	0	1	1	11	13
,	L	0	1	1	0	0	12	14
-	M	0	1	1	0	1	13	15
.	N	0	1	1	1	0	14	16
/	O	0	1	1	1	1	15	17
0	P	1	0	0	0	0	16	20
1	Q	1	0	0	0	1	17	21
2	R	1	0	0	1	0	18	22
3	S	1	0	0	1	1	19	23
4	T	1	0	1	0	0	20	24
5	U	1	0	1	0	1	21	25
6	V	1	0	1	1	0	22	26
7	W	1	0	1	1	1	23	27
8	X	1	1	0	0	0	24	30
9	Y	1	1	0	0	1	25	31
:	Z	1	1	0	1	0	26	32
;	[	1	1	0	1	1	27	33
<	\	1	1	1	0	0	28	34
=	]	1	1	1	0	1	29	35
>	^	1	1	1	1	0	30	36

Table 2.1. Address codes for various Address switch settings. The factory setting is indicated by the shaded area.

Fig. 2.1. Address switch setting as displayed on the 2032

2.2. DIGITAL I/O PUSHKEYS

The DIGITAL I/O "Local" pushkey is used to switch the 2032 front panel from the remote to the local state, (see Section 2.3).

The four DIGITAL I/O pushkeys, "Input", "Output", "Plot", and "Stop" are intended for manual control of the 2032 interface. However, these pushkeys are not usually used when the 2032 interface is under computer control, except in the following situations:

1. Pressing the "Input" pushkey following a JOB error causes the 2032 to read and display the data being transmitted by the controller.
2. Pressing the "Stop" pushkey following a JOB error resets the JOB specification and clears the error.

When the DIGITAL I/O push keys are used for manual control of the data transfer between the 2032 and other peripherals (e.g., a printer or digital cassette recorder), ensure that the controller interface is either reset to a passive state or disconnected. Otherwise incorrect data might be transfered.

2.3. REMOTE/LOCAL

The 2032 front panel pushkeys are accessible both manually and from an IEC/IEEE interface controller. However, although access from a controller is always possible, the controller can inhibit manual access. Three possibilities exist:

Local: The "Local" L.E.D. is on. The front panel controls are manually accessible.

Remote: The "Local" L.E.D. is off, and manual access to the 2032 front panel pushkeys is inhibited. However, the "Local" pushkey is manually accessible, and if pressed, switches the 2032 to its Local state.

Local Lockout: The "Local" L.E.D. is off, and manual access to any of the 2032 front panel pushkeys is inhibited.

Note that complete use of the REMOTE/LOCAL function depends on the controller connected. Refer to your controller manual for details.

2.4. INTERFACE JOB

Before data, (e.g. pushkey codes, measured data ect.), can be transfered between the 2032 and an IEC/IEEE controller the data type must be specified according to a message syntax in the following called a JOB. Details of use of the individual JOBs can be found in Chapter 3.

2.4.1. JOB syntax

In Chapter 3 a syntax diagram is given for each JOB. The generalized syntax diagram given in Fig. 2.2 is explained in the following.

The JOB header syntax follows the rules for a 2-letter mnemonic given in Section 2.4.2. The separator following the JOB header is always a space when the 2032 sends the header. When, however, the 2032 receives the header, a space, comma, or semicolon will be accepted. Likewise, the parameters and data items will always be separated by commas when the 2032 sends data, but when the 2032 receives data, a comma or a semicolon will be accepted.

T_e is the JOB terminator. This can be set to any of the allowed values in Table 2.2 via the Terminator field on the 2032 Display (Fig. 2.3) or by using the JOB "DEFINE_ TERMINATOR" (see Section 3.23). Note that use of the Digital Cassette Recorder Type 7400 requires ETX or EOT as the terminator, while most controllers require LF (Line Feed).

In the syntax diagrams shown in the following Sections, the JOB header Separator is shown as "S_P" (space), the Parameter Separator as "S_e", and the terminator as "T_e".

The parameter and data types are indicated by the following codes:

1. N: Numeric (ASCII)
2. A: ISO 7-bit code (ASCII)
3. B: 8-bit binary code

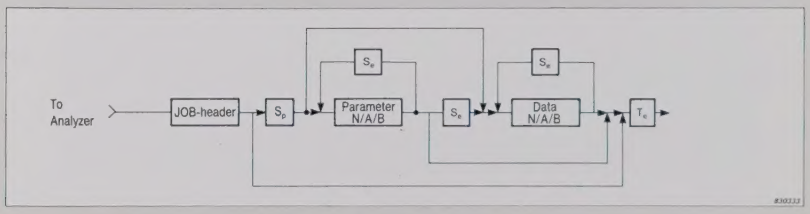


Fig. 2.2. JOB syntax diagram

Bit Numbers $b_4\ b_3\ b_2\ b_1$	b_7 0 b_6 0 b_5 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
0 0 0 0	NUL	● DLE	SP	0	● @	P	● `	p
0 0 0 1	● SOH	● DC1	● !	1	A	Q	a	q
0 0 1 0	● STX	● DC2	"	2	B	R	b	r
0 0 1 1	● ETX	● DC3	● #	3	C	S	c	s
0 1 0 0	● EOT	● DC4	● $	4	D	T	d	t
0 1 0 1	● ENQ	● NAK	● %	5	E	U	e	u
0 1 1 0	● ACK	● SYN	● &	6	F	V	f	v
0 1 1 1	● BEL	● ETB	'	7	G	W	g	w
1 0 0 0	● BS	● CAN	● (	8	H	X	h	x
1 0 0 1	● HT	● EM	●)	9	I	Y	i	y
1 0 1 0	● LF	● SUB	● *	● :	J	Z	j	z
1 0 1 1	● VT	● ESC	+	;	K	● [	k	● {
1 1 0 0	● FF	● FS	,	● <	L	● \	l	● ¦
1 1 0 1	CR	● GS	-	● =	M	●]	m	● }
1 1 1 0	● SO	● RS	.	● >	N	● ^	n	● ~
1 1 1 1	● SI	● US	● /	● ?	O	_	o	● DEL

Table 2.2. ASCII characters. The allowed terminators are indicated by ●

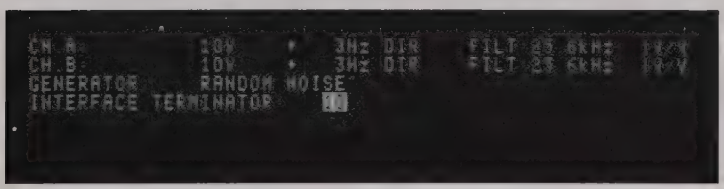


Fig. 2.3. Display field for setting the interface terminator

2.4.2. Two-letter mnemonics

A two-letter mnemonic can be transferred to the 2032 in many different formats. For example, the mnemonic ED can be transferred as follows:

ED
EDWARD
E_ DISPLAY
EDIT_ D
EDIT_ DISPLAY
ERIC_DAVID_SMITH

The general rule is that if only one word is transmitted, then the first two letters of the word are interpreted as the mnemonic, while if more than one word is transmitted, the mnemonic becomes the first letter of the first two words. The total number of letters is limited to 31 and both upper and lower case letters are permitted.

The separator between words can be either _ (underline), - (hyphen), or . (period). When the 2032 sends a JOB header or parameter, the minimum upper case letter code is used, (for example in this case, ED).

2.5. JOB CANCELLATION

Any JOB can be cancelled by the controller by:

1. Sending Device Clear or Selected Device Clear, or
2. Sending a new JOB specification while the 2032 is awaiting to output data.

Any JOB can be cancelled manually from the 2032 front panel controls by:

1. Pressing DIGITAL I/O "Stop", or
2. Pressing SYSTEM RESET

2.6. ERROR CANCELLATION

A digital I/O error can be cancelled by the controller by:

1. Sending Device Clear or Selected Device Clear, or
2. Conducting a Serial Poll if the SRQ mask bit for I/O errors has been set

A digital I/O error can be cancelled manually by:

1. Pressing DIGITAL I/O "Stop", or
2. Pressing SYSTEM RESET

Note that if incorrect data is sent to the MEASUREMENT or DISPLAY SETUP or to the memory using one of the block transfer JOBs severe error conditions can occur. This type of error can only be cancelled by:

1. Sending Device Clear followed by the JOBs "DEFINE_ TERMINATOR" and "SYSTEM_ RESET 9" within 1 second, or
2. Manually Selecting SYSTEM RESET 9

A list of all the error messages can be found in Chapter 4.

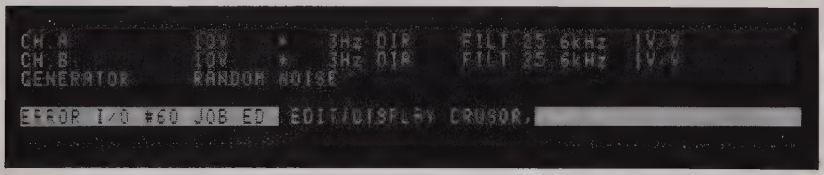


Fig. 2.4. Error message caused by a wrong parameter

3. JOB DESCRIPTION

The 2032 interface JOBs can be divided into 7 groups, each dealing with a specific type of data transfer. The JOBs are listed in Table 3.1 and described in the following sections. The most important information is stated about each JOB except for the "SIGNAL_ PROCESS_ PROGRAM", "CONTROL-PROCESS" and the block transfer JOBs. For a complete description of all JOBs, refer to the 2032 main Interface Manual.

Job Group	Job Name	Section
Key control	KEY_PUSH	3.1
	KEY_BINARY_PUSH	3.2
	CURRENT_STATUS	3.3
	DISPLAY_FORMAT	3.4
	UPPER_DISPLAY	3.5
	LOWER_DISPLAY	3.5
	SYSTEM_RESET	3.6
Setup	EDIT_DISPLAY	3.7
	EDIT_MEASUREMENT	3.8
	DISPLAY_SPECIFICATION	3.9
	MEASUREMENT_SPECIFICATION	3.10
Result I/O	CURSOR_READING	3.11
	ACTUAL_FUNCTION	3.12
	ACTUAL_BINARY_FUNCTION	3.12
	TIME_HISTORY	3.13
	TOTAL_DOCUMENTATION	3.14
Display I/O	WRITE_TEXT	3.15
	PROMPT	3.16
	GRAPHIC_CURSOR	3.17
	ACTUAL_GRAPH	3.18
	PLOT_FOREGROUND	3.19
	PLOT_CONT_IN_FOREGROUND	3.19
	PLOT_BACKGROUND	3.19
	RECORDER_PLOT	3.19
	DRAW_CONT_FOREGROUND	3.20
	DRAW_BACKGROUND	3.20
	DRAW_GREYTONE	3.21
	DUMP_PLOT	3.22
Bus Control	DEFINE_TERMINATOR	3.23
	DEFINE_MASK_FOR_SRQ	3.24
Miscellaneous	ERROR_RECORD	3.25
	IDENTIFY	3.26
	CONTROL_PROCESS	3.27
	SIGNAL_PROCESS_PROGRAM	3.28
Memory I/O	BLOCK_ASCII_TRANSFER	3.29
	BLOCK_BINARY_TRANSFER	3.29
	BLOCK_SPLIT_TRANSFER	3.29
	BLOCK_LOGICAL_TRANSFER	3.29

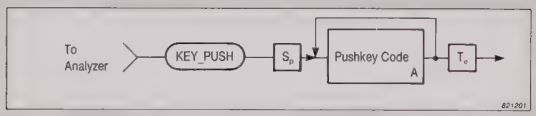
Table 3.1. Job groups

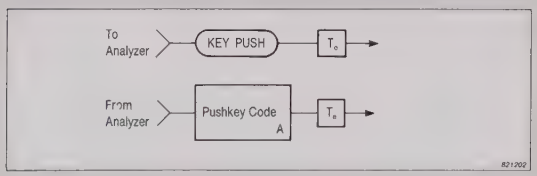
3.1. KEY_ PUSH

Sets and senses the front panel pushkeys.
All the front panel pushkeys can be set and sensed by a controller with the following exceptions:

1. SYSTEM RESET can neither be sensed nor set, (see Section 3.6)
2. DIGITAL I/O "Local" cannot be set.
3. DIGITAL I/O "Input", "Plot", "Output", and the SPECIAL FUNCTION pushkeys can only be set when the 2032 front panel is in its alpha mode.

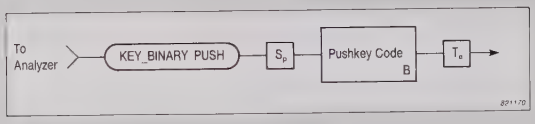
The pushkey codes are given in Table 3.2.

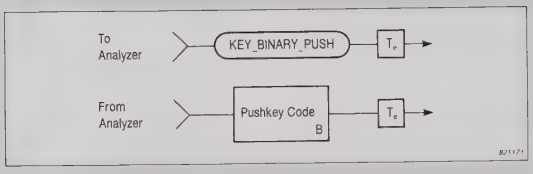




3.2. KEY_BINARY_PUSH

Carries out the same function as KEY PUSH except that the pushkey codes are in binary form. The key codes are given in Table 3.2.





	Pushkey		'KP' Code ASCII	ASCII Code Decimal	'KB' Code Decimal
	INPUT AUTORANGE		S_p	32	158
CONTROL	AVERAGING	'Start'	A	65	155
		'Proceed'	B	66	154
		'Stop'	C	67	153
	RECORD	'Cont'	G	71	164
		'Single'	H	72	191
		'Stop'	I	73	157
	MANUAL TRIGGER		L	76	172
	MEMORY	'Enable'	M	77	174
		'Store'	N	78	176
DISPLAY	AUTO SCALE		D	68	152
	FORMAT		E	69	151
	MEASUREMENT SETUP		F	70	150
	SET SPECIAL CURSORS		J	74	166
	ALIGN CURSORS		K	75	167
	TEXT		t	116	168
	SAVE SETUP	'Measurement'	O	79	177
		'Display'	P	80	179
	ALPHA		'	39	181
FIELD SELECT	MOVE	'Up'	^	94	160
		'Down'	–	95	162
		'Left'	<	60	161
		'Right'	>	62	163
	SETUP LABEL	'Measurement'	Q	81	169
		'Display'	R	82	170
	CURSOR		S	83	171
FIELD ENTRY	STEP	'Up'	T	84	149
		'Down'	U	85	148
	KEY PAD	'0'	0	48	128
		'1'	1	49	129
		'2'	2	50	130
		'3'	3	51	131
		'4'	4	52	132
		'5'	5	53	133
		'6'	6	54	134
		'7'	7	55	135
		'8'	8	56	136
		'9'	9	57	137
		'–'	–	45	138
		'.'	.	46	139
		'k'	k	107	140
		'm'	m	109	142
		'μ'	u	117	141
		'E'	e	101	144
		'unmarked'	~	126	147
		'CLR'	#	35	146
		'←'	DEL	127	143
830538		'ENT'	p	112	145

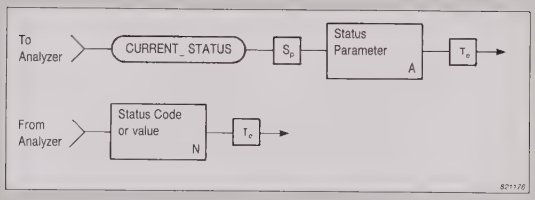
Table 3.2. Pushkey codes

	Pushkey		'KP' Code ASCII	ASCII Code Decimal	'KB' Code Decimal
	KNOB COUNTER CLOCKWISE	MIN	R_s	30	67
			$	36	69
			%	37	71
			&	38	73
			:	58	75
			?	63	77
			"	34	79
			\	92	81
			`	96	83
			a	97	85
			b	98	87
			c	99	89
			f	102	91
			g	103	93
		MAX	(	40	95
	KNOB CLOCKWISE	MIN	U_s	31	66
			h	104	68
			i	105	70
			n	110	72
			o	111	74
			;	59	76
			q	113	78
			r	114	80
			v	118	82
			x	120	84
			y	121	86
			{	123	88
			¦	124	90
			}	125	92
		MAX	)	41	94
	DIGITAL I/O	'Input'	+	43	0
		'Output'	*	42	1
		'Plot'	/	47	2
		'Stop'	=	61	3
		'Local'	I	108	4
	GENERATOR on/off		[	91	5
	UNMARKED KEY		]	93	6
	RECORDER	'Start'	,	44	7
		'Stop'	!	33	8
		'Cal'	@	64	9
	SPECIAL FUNCTION KEYS	1	d	100	10
		2	j	106	11
		3	s	115	12
		4	z	122	13
		5	w	119	14
		6	V	86	15
		7	W	87	16
		8	X	88	17
		9	Y	89	18
830538		10	Z	90	19

Table 3.2. Continued

3.3. CURRENT_ STATUS

Outputs the status of the front panel pushkey L.E.D.s and the 2032 Display. If the Display is in an "upper-lower" format, the Status information corresponds to the DISPLAY SETUP containing the Field Selector. The Status parameters and codes are given in Table 3.3.



CS Parameters	Parameter Code	Status Code	Status
ALIGN_CURSORS	AC	0 1	not Aligned Aligned
ALPHA	AL	0 1	Alpha mode not selected Alpha mode selected
AVERAGING_NUMBER _REACHED	AN		0 to 32767
AVERAGING_STATE	AS	0 1 2	Stop Proceed Start
CONFLICT_FLAGS	CF	0 1	no conflicts conflicts
DISPLAY_GRAPHIC	DG	0 1	A Foreground B Foreground
DUAL_LOWER_SELECTED	DL	0 1	not Selected Selected
FIELD_LIST	FL	0 1	Off On
FIELD_SELECTOR_POSITION	FS		see the main manual
GRAPH_BLANKED	GB	0 1	not Blanked Blanked
GENERATOR_ON	GO	0 1	Off On
INPUT_AUTORANGE	IA	0 1	Inactive In Process
INPUT_OVERLOAD	IO	0 1 2 3	None Channel A Channel B Channel A + Channel B
LIFTER_RANGE_INDICATED	LR	0 1	not Indicated Indicated
MEMORY_ENABLE	ME	0 1	not Enabled Enabled
OVERLAP_FAIL	OF	0 1	no Fail Fail

Table 3.3. Status parameters and codes

CS Parameters	Parameter Code	Status Code	Status
ORIGINAL_DISPLAY_SETUP	OD	1 to 20	
ORIGINAL_MEASUREMENT_SETUP	OM	1 to 20	
PRESS_START_OR_PROCEED	PS	0 1	Off On
RECORD_OVERLOAD	RO	0 1	no Overload Overload
RECORDING_STATE	RS	0 1 2	Stop Single Cont.
SEARCHING_FOR_TRIGGER	SF	0 1	not Searching Searching
TEXT_LINES	TL	–2 –1 0 1 2	Text 2 enabled but not displayed Text 1 enabled but not displayed No text Text 1 enabled and displayed Text 2 enabled and displayed
TRIGGERED	TR	0 1	not Triggered Triggered
UNIT_CODE_SPECIAL_CURSOR	UC		See X_UNIT_CODE
UNRELIABLE_DOCUMENTATION	UD	0 1	Documented not Documented
USED_MEASUREMENT_SETUP	UM	–2 to 20	
USED_ORIGINAL_MEAS_SETUP	UO	1 to 20	
WARNING_FLASHING_FIELDS	WF	0 1	no Warning Warning
X_AXIS_CODE	XA	0 1 2 3 4 5 6	Frequency Time Amplitude (Nyquist–frequency function) Phase (Nichols–frequency function) Amplitude (Nyquist–time function) Phase (Nichols–time function) Amplitude (Probability)

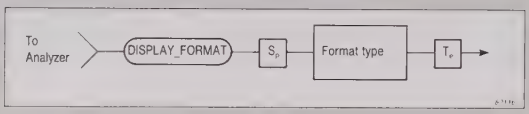
Table 3.3. Continued

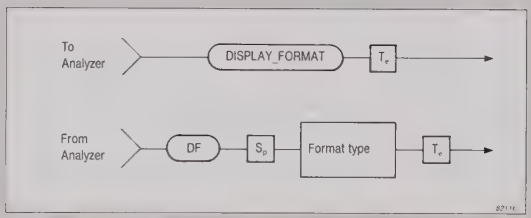
CS Parameters	Parameter Code	Status Code	Status
X_UNIT_CODE and Y_UNIT_CODE	XU and YU	0	V
		1	V^2
		2	V^2/Hz
		3	V^2s/Hz
		4	dB
		5	Degrees
		6	%
		7	%/V
		8	%/RMS
		9	"Blank"
		10	Hz
		11	s
		12	$V^2(W/m^2)$
		13	V^2s
		14	dB/Yref
		15	dB/Yref*Hz
		16	dB/$Yref^2$*s
		17	V (Probability)
X_Y_RECORDER_STATE	XY	0	Stop
		1	Cal
		2	Start
ZOOM_RANGE_INDICATED	ZR	0	Not Indicated
		1	Indicated

Table 3.3. Continued

3.4. DISPLAY_ FORMAT

Directly sets the 2032 Display to any of the 5 possible formats, or transfers the setting of the format to the controller. The 5 formats are given in Table 3.4.



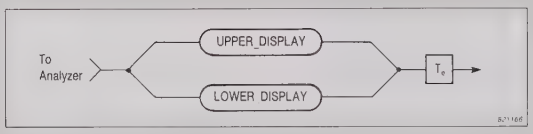


Display Format Type	Mnemonic
UPPER_FULL_GRAPH	UF
UPPER_MEASUREMENT_SETUP	UM
UPPER_LOWER_GRAPH	UL
LOWER_MEASUREMENT_SETUP	LM
LOWER_FULL_GRAPH	LF

Table 3.4. Display formats

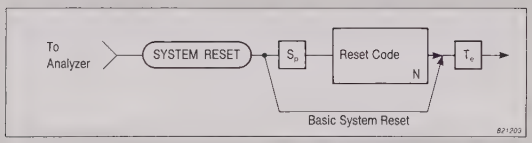
3.5. UPPER_ DISPLAY
LOWER_ DISPLAY

If a single grahp is displayed, the specified graph, (Upper or Lower) is selected. If two graphs are displayed, the Field Selector is moved to the specified DISPLAY SETUP.



3.6. SYSTEM_ RESET

Used to select any level of the 2032 SYSTEM RESET. The level selected depends on the parameter. Device Clear and Selected Device Clear correspond to sending the SYSTEM RESET header without a parameter. Note that this JOB cannot be used for JOB and JOB error cancellation, see Sections 2.5 and 2.6.

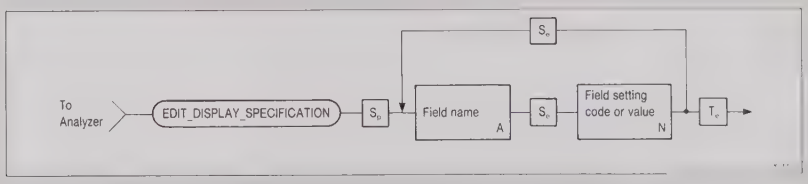


Reset Type		Reset Code
SYSTEM_RESET	1	1
	2	2
	9	9
CURSOR_RESET		171
DIGITAL_SELF_TEST		- 1
ANALOG_SELF_TEST		- 2
RECORD_STOP		157

Table 3.5. "SYSTEM_ RESET"

3.7. EDIT_DISPLAY_SPECIFICATION

Operates on the DISPLAY SPECIFICATION (see Fig. 3.1) containing the Field Selector. If a number follows the field name the field is changed accordingly. Otherwise the 2032 outputs the selected field value, or the letter B if the field cannot be selected. If it is attempted to alter a non selectable field, an error message is given. The edit parameters and codes are given in Table 3.6.



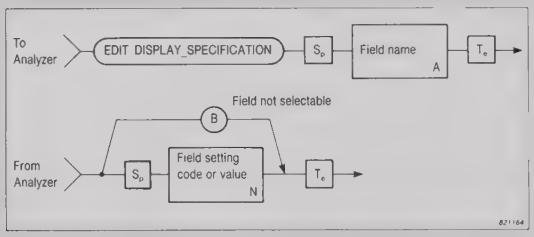


Fig. 3.1. DISPLAY SPECIFICATION fields

	Field name	Field name Code	Field setting Code	Field setting
FUNCTION	FUNCTION	FU	0	TIME CH.A
			1	TIME CH.B
			2	TIME A VS B
			3	ENH TIME CH.A
			4	ENH TIME CH.B
			5	ENH TIME A VS B
			6	PROB DENS CH.A
			7	PROB DENS CH.B
			8	PROB DIST CH.A
			9	PROB DIST CH.B
			10	INST SPEC CH.A
			11	INST SPEC CH.B
			12	ENH SPEC CH.A
			13	ENH SPEC CH.B
			14	AUTO SPEC CH.A
			15	AUTO SPEC CH.B
			16	CROSS SPEC
			17	FREQ RESP H1
			18	1/FREQ RESP H1
			19	FREQ RESP H2
			20	1/FREQ RESP H2
			21	COHERENCE
			22	SIG/NOISE RATIO
			23	COHERENT POWER
			24	NONCOHER POWER
			25	AUTO CORR CH.A
			26	AUTO CORR CH.B
			27	CROSS CORR
			28	IMPULSE RESP
			29	SOUND INTENSITY
			30	CEPSTRUM CH.A
			31	CEPSTRUM CH.B
			32	LIFT SPEC CH.A
			33	LIFT SPEC CH.B
	FUNCTION_COORDINATES	FC	0	REAL
			1	IMAG
			2	MAG
			3	PHASE
			4	NYQUIST
			5	NICHOLS
	A_WEIGHTING	AW	0	Off
			1	On
Y-AXIS	YAXIS_FULL_SCALE	YF	numeric	
	YAXIS_UNIT	YU	0	Absolute or %/V
			1	Relative or %/RMS
	YAXIS_DB_REFERENCE	YD	numeric	

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Table 3.6. Field names and field codes or values for "EDIT_ DISPLAY_ SPECIFICATION"

	Field name	Field name Code	Field setting Code	Field setting
X-AXIS	SPECTRUM_UNIT	SU	0 1 2 3	RMS PWR PSD ESD
	YAXIS_RANGE_DB	YR	numeric	
	YAXIS_LIN_LOG	YL	0 1	LIN LOG
	DELAY_COMPENSATION	DC	numeric	
	XAXIS_START	XS	numeric	
	XAXIS_WIDTH	XW	numeric	
	XAXIS_PROBABILITY_RES	XP	numeric	
	XAXIS_LIN_LOG	XL	0 1	LIN LOG
POST PROCESSING	INTEGRATION_DIFFERENTION	ID	0 1 2 3 4	Double Integration Integration Off Differentiation Double Differentiation
	BOWTIE_CORRECTION_OFF	BC	0 1	BWTC ON BWTC OFF
	LIFTER_TYPE	LT	0 1	SHORTPASS LONGPASS
	LIFTER_WIDTH	LW	numeric	
CURSOR	DATA_SOURCE	DS	0 1 2	INPUT STORED EQUALIZED
	CURSOR_TYPE	CT	0 1 2 3 4 5	MAIN HARM SIDB DELT MASK REF
	CURSOR	CU	numeric	
	SPECIAL_CURSOR_SPACING	SC	numeric	
	AUXILIARY_INFORMATION	AI	0 1 2 3 4 5 6	Off Δ Y ELEM # TOTAL Δ TOTAL Δ/TOTL FLEX
	FLEX_VALUE	FV	numeric	

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Table 3.6. Continued

	Field name	Field name Code	Field setting Code	Field setting
SETUP	SETUP_LABEL	SL	numeric	
	SAVE SETUP	SS	numeric	

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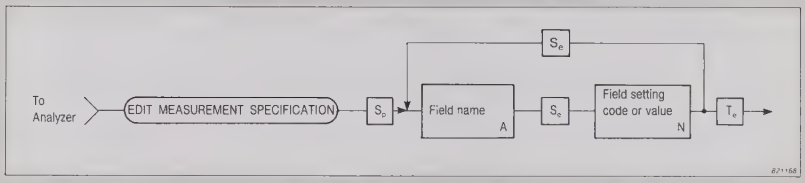
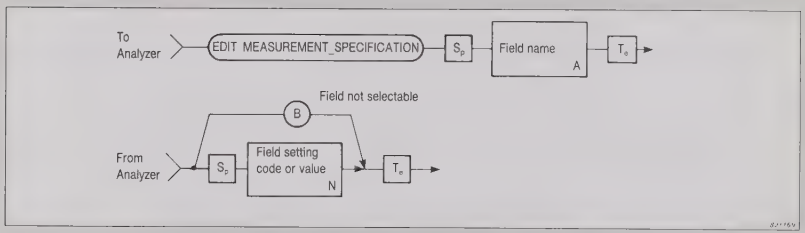
Table 3.6. Continued

3.8. EDIT_MEASUREMENT_SPECIFICATION

Used to display the MEASUREMENT SPECIFICATION (see Fig. 3.2) and move the Field Selector to the specified field. If a number follows the field name, the field value is changed accordingly. Otherwise the 2032 outputs the selected field value, or the letter B if the field cannot be selected. If it is attempted to alter a non selectable field, an error message is given. The edit parameters and codes are given in Table 3.7.





SETUP 2
MEASUREMENT: DUAL SPECTRUM AVERAGING
TRIGGER: FREE RUN
DELAY: CH A+B: 0.000mS
AVERAGING: LIN 1000 OVERLAP: MAX
FREQ SPAN: 6.4kHz AF:8Hz T:125mS dT:61.0mS
CENTER FREQ: BASEBAND
WEIGHTING: HANNING
CH.A: 20V A 3Hz DIR FILT:25.6kHz 10/V
CH.B: 15V A 3Hz DIR FILT:25.6kHz 10/V
GENERATOR: RANDOM NOISE

Fig. 3.2. MEASUREMENT SPECIFICATION fields

	Field name	Field name code	Field setting code	Field setting
MEASUREMENT	MEASUREMENT_CHANNEL	MC	0 1 2	CH. A CH. B DUAL
	MEASUREMENT_MODE	MM	0 1 2 3	SPECTRUM AVERAGING SPECTRUM AVERAGING ZERO PAD SIGNAL ENHANCEMENT AMPLITUDE PROBABILITY
TRIGGER	TRIGGER_MODE	TM	0 1 2 3 4 5 6 7	FREE RUN CH. A CH. A FILT CH. B CH. B FILT EXTERNAL GENERATOR MANUAL
	TRIGGER_SLOPE	TS	0 1	+ SLOPE - SLOPE
	TRIGGER_LEVEL	TL	numeric	
DELAY	DELAY_AFTER_TRIGGER	DA	numeric	
	DELAY_BETWEEN_CHANNELS	DB	numeric	
AVERAGING	AVERAGING_TYPE	AO	0 1 2	EXP LIN PEAK
	AVERAGING_NUMBER	AN	numeric	
	AVERAGING_OVERLAP		0 1 2 3	0 % 50 % 75 % MAX
	AVERAGING_ACCEPT	AA	0 1	AUTO ACCEPT MANUAL ACCEPT
FREQUENCY	FREQUENCY_SPAN	FS	numeric	
	ZOOM_BASEBAND	ZB	0 1	ZOOM BASEBAND
	CENTER_FREQUENCY	CF	numeric	
	EXTERNAL_SAMPLING	ES	0 1	INT SAMPL EXT SAMPL

Table 3.7. Field names and field codes or values for "EDIT_ MEASUREMENT_ SPECIFICATION"

	Field name	Field name code	Field setting code	Field setting
WEIGHTING	WEIGHTING_DIFFERENT	WD	0 1	Off On
	A_WEIGHTING_FUNCTION	AW	0 1 2 3 4 5 6	RECTANGULAR HANNING TRANSIENT EXPONENTIAL FLAT TOP KAISER-BESS USER DEF
	A_SHIFT_OF_WEIGHTING	AS	numeric	
	A_LENGTH_OF_WEIGHTING	AL	numeric	
	B_WEIGHTING_FUNCTION	BW	0 1 2 3 4 5 6	RECTANGULAR HANNING TRANSIENT EXPONENTIAL FLAT TOP KAISER-BESS USER DEF
	B_SHIFT_OF_WEIGHTING	BS	numeric	
	B_LENGTH_OF_WEIGHTING	BL	numeric	
CH. A and CH. B ANALOG INPUT and CALIBRATION	A_MAX_VOLTAGE	AM	numeric	
	A_POLARITY	AP	0 1	+ –
	A_INPUT	AI	0 1 2 3 4 5	DC-DIRECT 3 Hz DIRECT 0,2 Hz ACC 3 Hz ACC PREAMP ZERO
	A_FILTER	AF	0 1 2 3	OFF 25,6 kHz 6,4 kHz BOTH
	A_CALIBRATION	AC	numeric	

Table 3.7. Continued

	Field name	Field name code	Field setting code	Field setting
CH.A and CH.B ANALOG INPUT and CALIBRATION	A_UNIT	AU	0	V/V
			1	V/UNIT
			2	V/Pa
			3	V/m/s²
			4	V/m/s
			5	V/m
			6	V/N
			7	V/PSI
			8	V/G
			9	V/IN/s
			10	V/MIL
			11	V/LBF
			12	UNIT/V
	B_MAX_VOLTAGE	BM	numeric	
	B_POLARITY	BP	0	+
			1	–
	B_INPUT	BI	0	DC-DIRECT
			1	3 Hz DIRECT
			2	0,2 Hz ACC
			3	3 Hz ACC
			4	PREAMP
			5	ZERO
	B_FILTER	BF	0	OFF
			1	25,6 kHz
			2	6,4 kHz
			3	BOTH
	B_CALIBRATION	BC	numeric	
	B_UNIT	BU	0	V/V
			1	V/UNIT
			2	V/Pa
			3	V/m/s²
			4	V/m/s
			5	V/m
			6	V/N
			7	V/PSI
			8	V/G
			9	V/IN/s
			10	V/MIL
			11	V/LBF
			12	UNIT/V
GENERATOR	GENERATOR_SIGNAL	GS	0	DISABLED
			1	IMPULSE
			2	REFERENCE SINE
			3	RANDOM NOISE
			4	PSEUDO RANDOM NOISE
			5	VARIABLE SINE

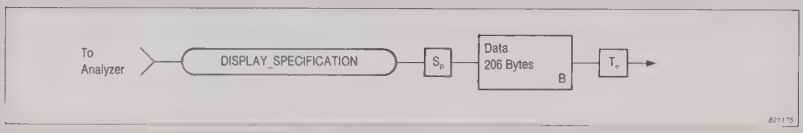
Table 3.7. Continued

	Field name	Field name code	Field setting code	Field setting
UNIVERSAL PARAMETERS	UNIVERSAL_PARAMETERS	UP	0 1 2 3 4 5 6 7 8	DISABLED SOUND INTENS. CALIBR. SINE GENERATOR FREQ. SPECIAL PARAMETER MAIN MEMORY SCRATCH PAD MEMORY CONTINUOUS MEMORY I/O ADDRESS SWITCH INTERFACE TERMINATOR
	SPACER	SP	0 1 2 3	6 mm 12 mm 50 mm SPEC
	TEMPERATURE	TE	numeric	
	PRESSURE	PR	numeric	
	SINE_GENERATOR_FREQ	SG	numeric	
	PARAMETER	PA	numeric	SPECIAL PARAMETER NUMBER
	VALUE_ENCODING	VE	0 1	DEC VALUE OCT VALUE
	VALUE	VA	numeric	
	ADDRESS_ENCODING	AE	0 1	DEC ADDR OCT ADDR
	ADDRESS	AD	numeric	
	INTERFACE_TERMINATOR	IT	numeric	
SETUP	SETUP_LABEL SAVE_SETUP	SL SS	numeric numeric	

Table 3.7. Continued

3.9. DISPLAY_ SPECIFICATION

Transfers the DISPLAY SETUP and some additional information regarding the DISPLAY SETUP to the controller (see Fig. 3.3). The data can later be transfered back to the 2032. However, no changes should be made to the setup in the controller, since otherwise severe error conditions and wrong results can occur when it is transfered back to the 2032, see Section 2.6. The data will be transfered back into the working display specification buffer of the 2032.



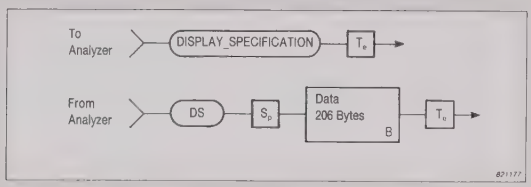
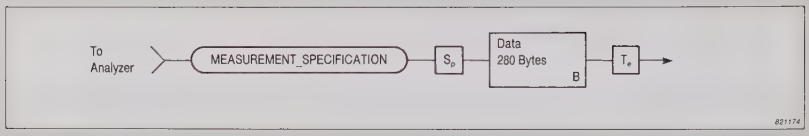
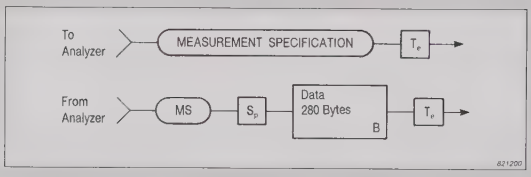


Fig. 3.3. Field information transferred by "DISPLAY_ SPECIFICATION"

3.10. MEASUREMENT_ SPECIFICATION

Transfers the MEASUREMENT SETUP and some additional information regarding the MEASUREMENT SETUP to the controller (see Fig. 3.4). The data can later be transfered back to the 2032. However, no changes should be made to the setup in the controller, since otherwise severe error conditions and wrong results can occur when it is transfered back to the 2032, see Section 2.6. The data will be transfered back into the working measurement specification buffer of the 2032.





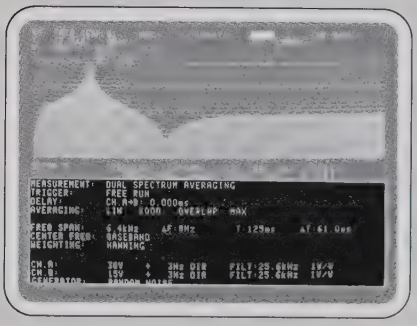
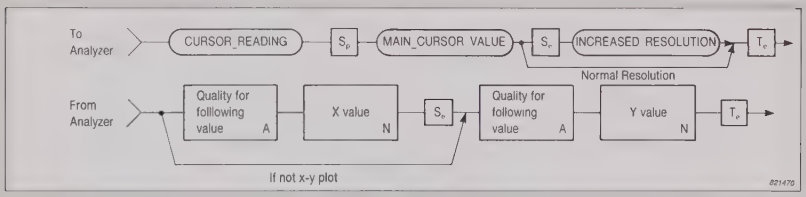
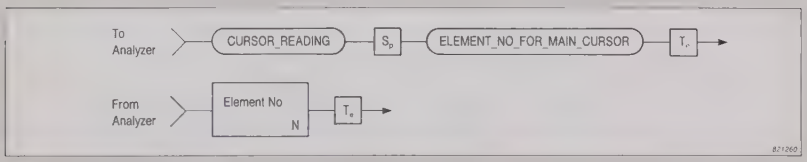

MEASUREMENT: DUAL SPECTRUM AVERAGING
TRIGGER: FREE RUN
DELAY: CH A>B: 0.000ms
AVERAGING: LIN 8000 OVERLAP MAX
FREQ SPAN: 6.4kHz Δf: 0Hz T:125ms Δf:61.0ms
CENTER FREQ: BASEBAND
WEIGHTING: HANNING
CH A: 70V 1 2Hz DIR FILT:25.6kHz 1V/V
CH B: 1SV 1 2Hz DIR FILT:25.6kHz 1V/V

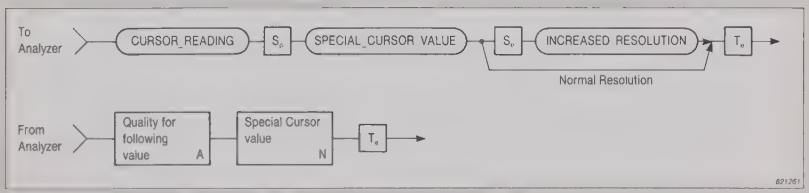
Fig. 3.4. Field information transferred by "MEASUREMENT_ SPECIFICATION

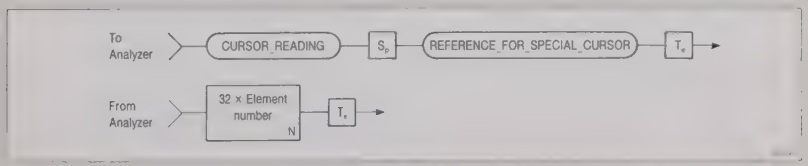
3.11. CURSOR_ READING

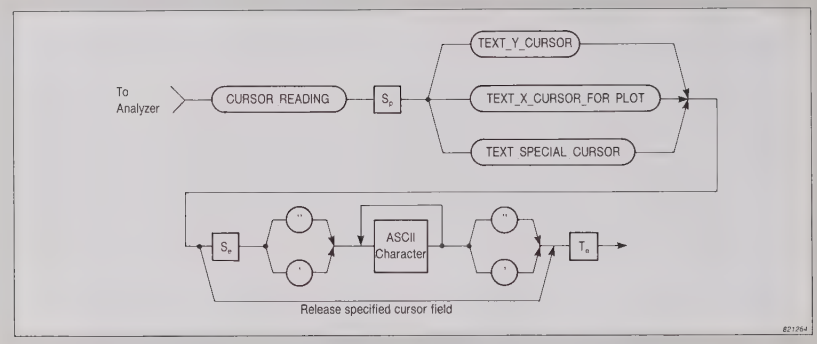
Used to transfer the main cursor value, or the selected element number, the special cursor value, or the reference for the special cursor to the controller. Note that the X-value of the main cursor is only transferred if an orbit plot is selected. The main and special cursor values are preceeded by a quality byte to indicate valid or bad data. This JOB can also be used to modify the X-cursor, Y-cursor, and special cursor value fields.
The data is read from or transferred to the DISPLAY SETUP containing the Field Selector.







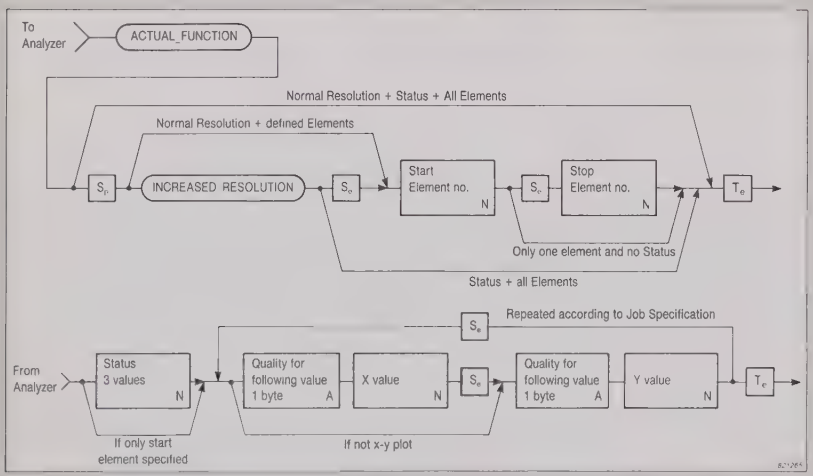


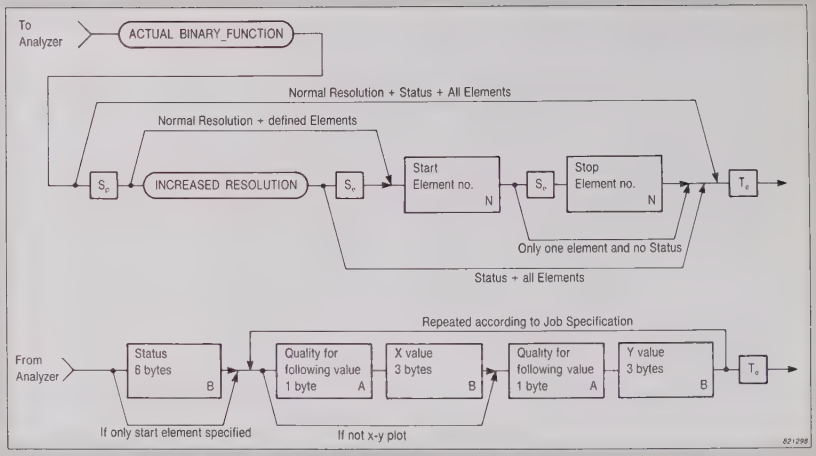

To
Analyzer
CURSOR READING
S_e
TEXT_Y_CURSOR
TEXT_X_CURSOR_FOR PLOT
TEXT SPECIAL CURSOR
S_e
''
'
ASCII
Character
''
'
T_e
Release specified cursor field
821264

3.12. ACTUAL_FUNCTION
ACTUAL_BINARY_FUNCTION

Transfers the cursor value of each line within a user defined span of the displayed function to the controller, in ASCII or binary format. Each cursor value is preceeded by a quality byte to indicate valid or bad data respectively. The X-cursor value is only transferred if an x–y plot is selected.

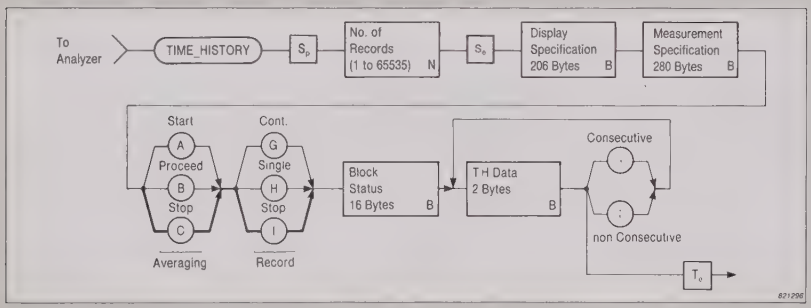
The data is transferred from the DISPLAY SETUP containing the Field Selector, and cannot be transferred back to the 2032.

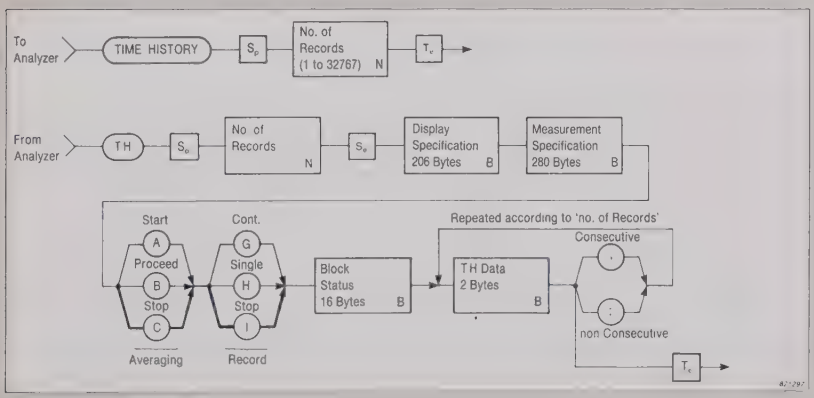



To
Analyzer
ACTUAL BINARY_FUNCTION
Normal Resolution + Status + All Elements
Normal Resolution + defined Elements
INCREASED RESOLUTION
Start
Element no.
N
Stop
Element no.
N
Only one element and no Status
Status + all Elements
Repeated according to Job Specification
From
Analyzer
Status
6 bytes
B
Quality for
following value
1 byte
A
X value
3 bytes
B
Quality for
following value
1 byte
A
Y value
3 bytes
B
If only start element specified
If not x-y plot
821298

3.13. TIME_ HISTORY

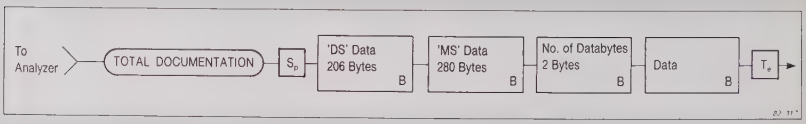
Used to read out the time signal directly from the zoom processor of the 2032. During read-out, any other data processing in the 2032 is stopped, in order to minimise the read-out time. The data can be transferred back to the 2032 for further analysis. For a complete description refer to the 2032 main interface manual.

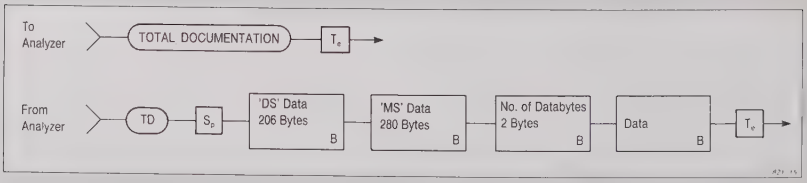




3.14. TOTAL_ DOCUMENTATION

Used to transfer a complete set of measurement data, the DISPLAY SPECIFICATION and the MEASUREMENT SPECIFICATION to the controller. The data can later be transferred back to the 2032. The number of bytes transferred is given in Table 3.8.



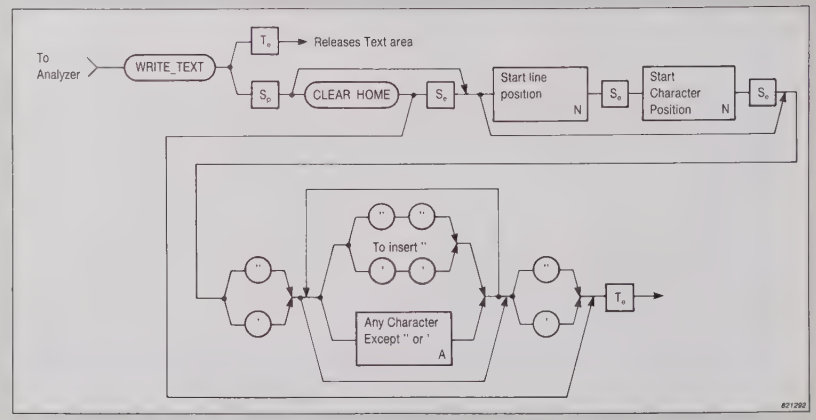


Measurement	Number of Bytes	
	Measurement Data	Total excl. terminator
Single spectrum averaging	8224	8715
Single spectrum averaging with zero pad	6176	6667
Dual spectrum averaging	24656	25147
Dual spectrum averaging with zero pad	20560	21051
Dual signal enhancement	24640	25131
Dual amplitude probability	12352	12843

Table 3.8. No. of bytes in 'TD' read-out

3.15. WRITE_ TEXT

Used to lock the text area of the 2032 Display such that new text can be written on the screen from the controller. The CLEAR-HOME parameter is used to clear the text area and to set the text cursor to the default position in the upper left hand corner of the text area. If the JOB header is sent without succeeding parameters, the text area is released.



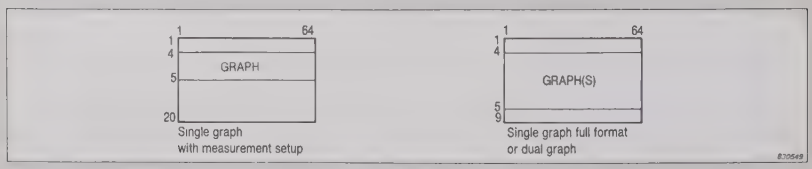
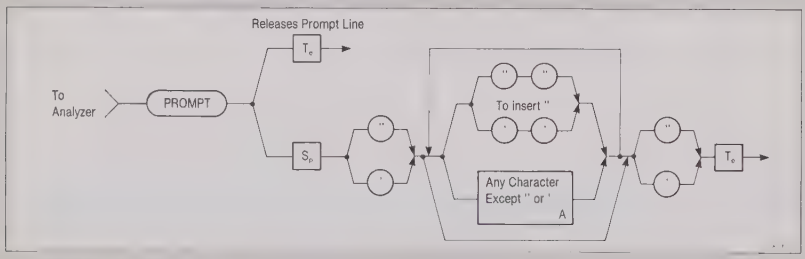


Fig. 3.5. Text line numbering

3.16. PROMPT

Allows the buttom line of the 2032 Display, to be locked such that new text can be written into it from the controller (only that part of the text line where a new text has been written is locked). When the line is full, the text will continuously move to the left as new characters are added. If the JOB header is sent without succeeding parameters, the line is released.



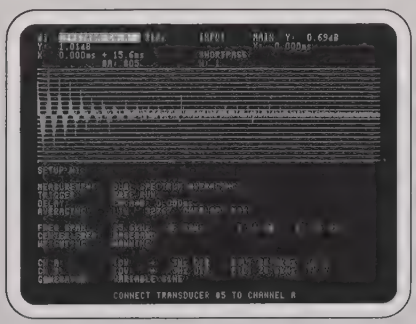


Fig. 3.6. Example on the use of the Prompt line

3.17. GRAPHIC_ CURSORS

Used to control the main and special graphic cursors while a user-defined graph or picture is displayed. The graphic cursors are released when the JOB header is sent without succeeding parameters.

Note that a Nyquist or Nichols display must be selected if "GRAPHICS_ CURSOR" is used in Dot mode.

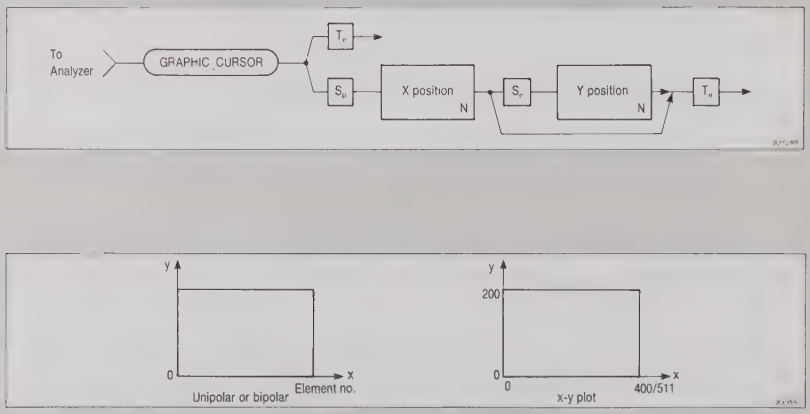
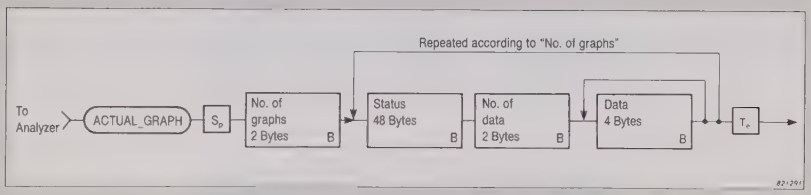
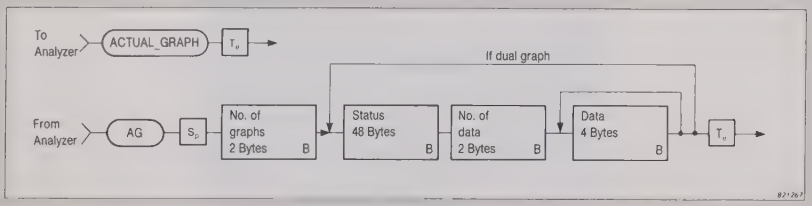


Fig. 3.7. Range for the X and Y position of the graphics cursor.

3.18. ACTUAL_ GRAPH

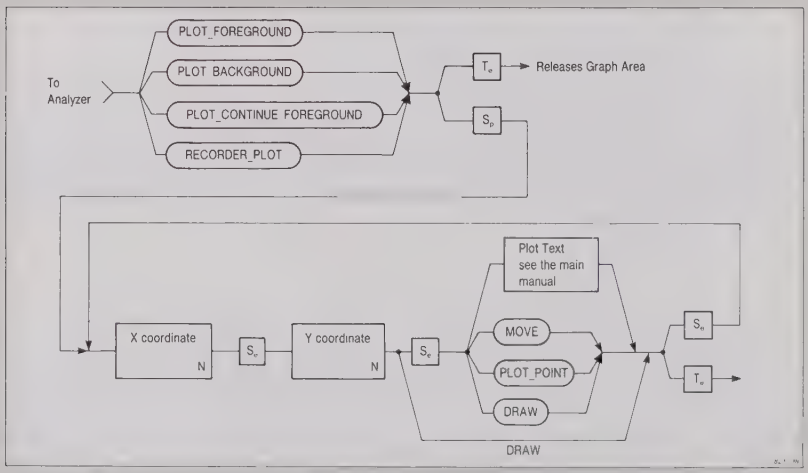
Transfers the graph(s) on the 2032 Display to the controller, or returns them to the 2032. Prior to return of a graph to the 2032, the MEASUREMENT SETUP, DISPLAY SETUP, and display format must be adjusted such that they are the same as when the graph was originally sent to the controller. The data format and scaling depends on the graph type, (see the main 2032 Interface Manual).





3.19. PLOT_ FOREGROUND
PLOT_ CONTINUE_ IN_ FOREGROUND
PLOT_ BACKGROUND
RECORDER_ PLOT

Used to plot points and lines on the 2032 Display, or an external x-y recorder. The foreground picture is updated immediately, while the background picture is shown when the plotting is complete. The plot area is released when the JOB header is sent without succeding parameters.



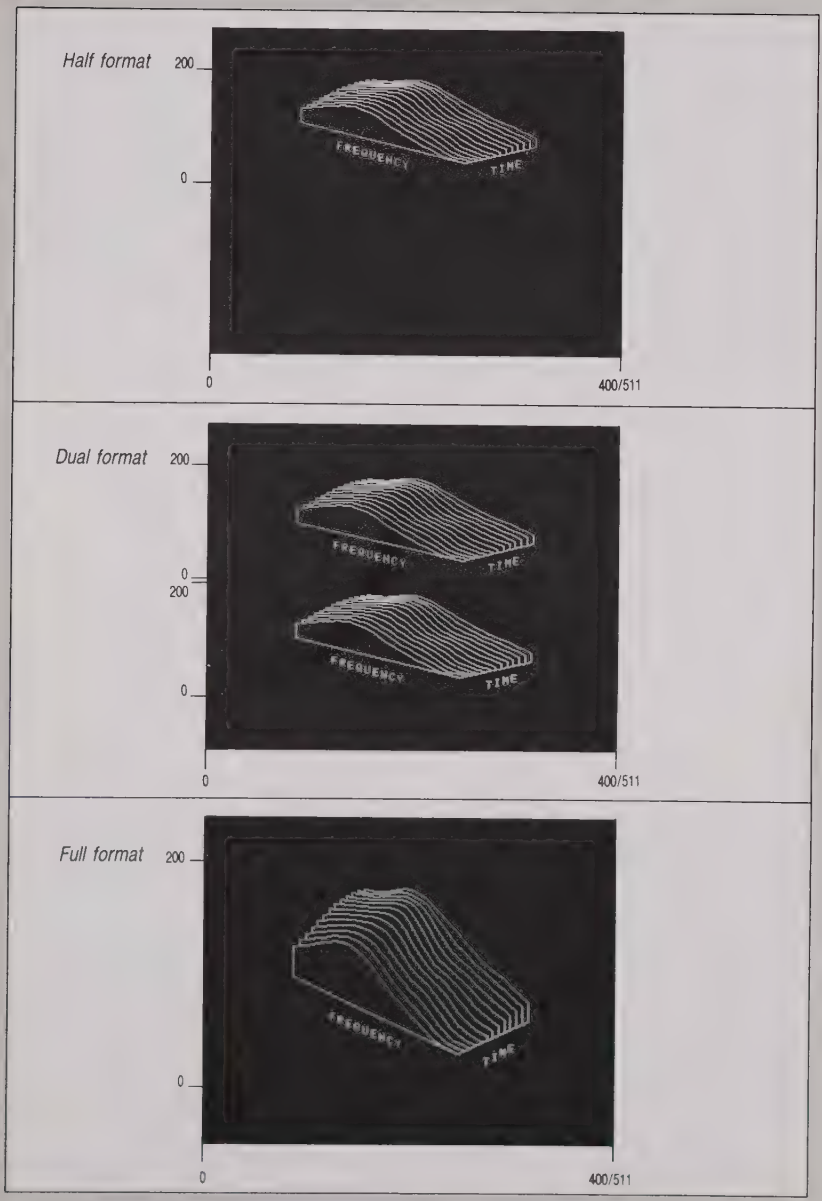
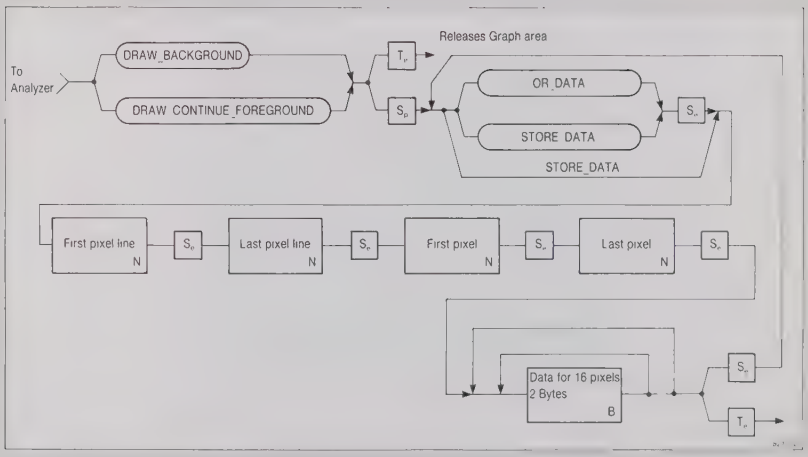


Fig. 3.8 Range for the X and Y coordinates

3.20. DRAW_BACKGROUND
DRAW_CONTINUE_FOREGROUND

Used to display black and white pictures in the graph area of the 2032 Display. The picture can be written either in the background or in the foreground. The graph area is made up of 401 or 512 dots in the horizontal direction and 103, 2 x 103, or 203 dots in the vertical direction, depending on the selected display mode and format. The start and stop dot for the picture can be defined in steps of 16 dots, (2 bytes), in the horizontal direction and 1 dot in the vertical direction. An optional parameter defines if the data is to be overwritten or ORed into the display buffer.



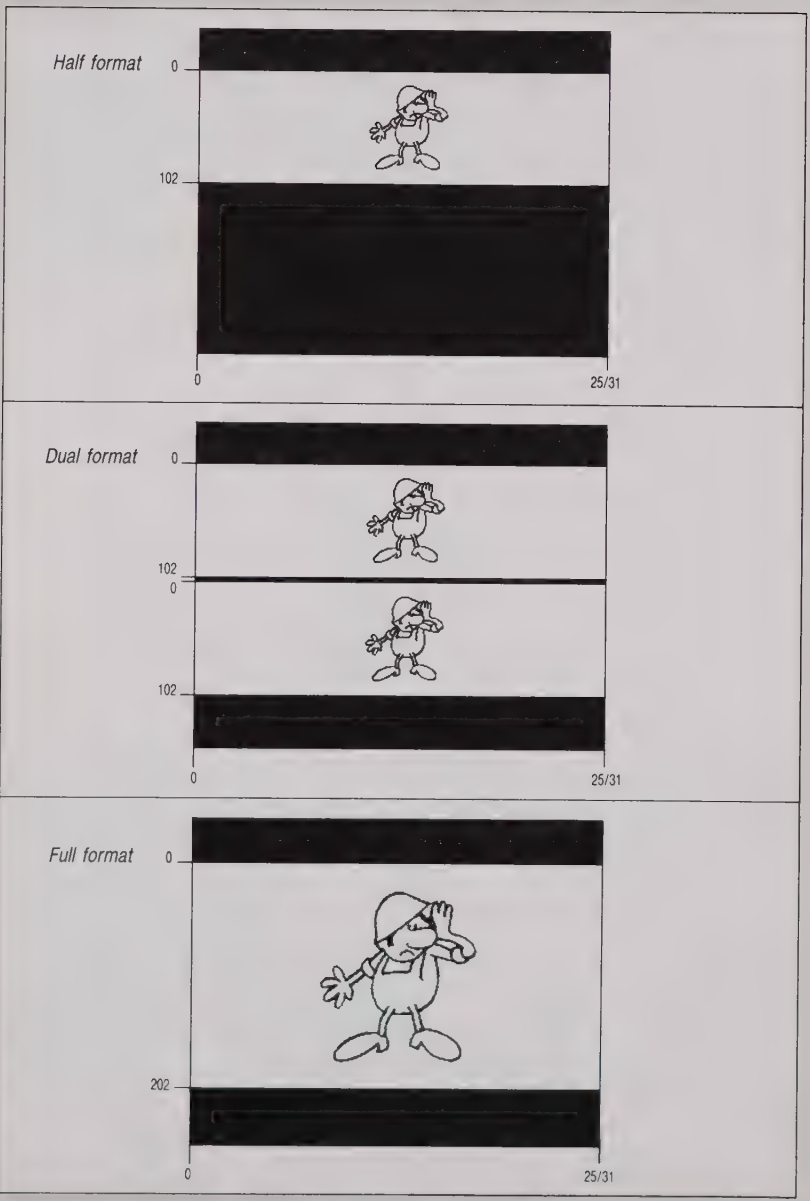
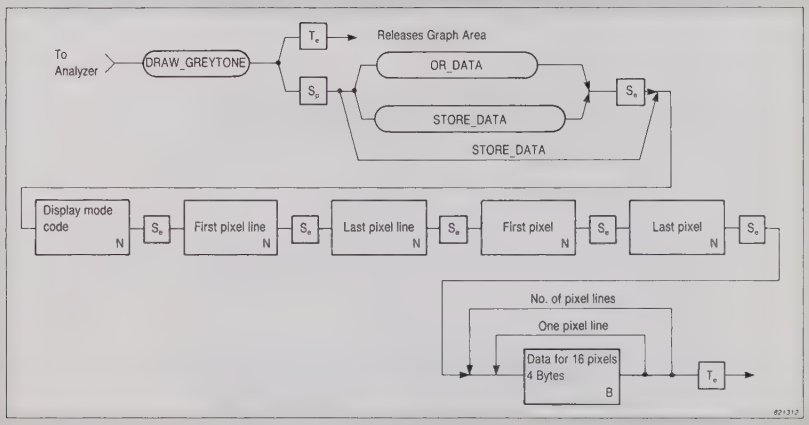


Fig. 3.9. Range of pixel coordinates

3.21. DRAW_GREYTONE

Used to display a greytone picture in the graph area of the 2032 Display. The greytone picture is formed by combining the fore- and background pictures, (see the 2032 main Interface Manual for details). The graph area is made up of 401 or 512 dots in the horizontal direction and 101, 2 × 101, or 201 dots in the vertical direction, depending on the selected display mode and format. The start and stop dot of the picture can be defined in steps of 16 dots, (4 bytes), in the horizontal direction and 1 dot in the vertical direction. An optional parameter defines if the data is to be overwritten or ORed into the display buffer.



Display Mode Code	Width Pixel	Scale Lines
1	512	–
2	512	Unipolar
3	512	Bipolar
4	512	Nyquist
5	401	–
6	401	Unipolar
7	401	Bipolar
	401	Nyquist

Table 3.9. Display mode codes used in "DRAW_ GREYTONE"

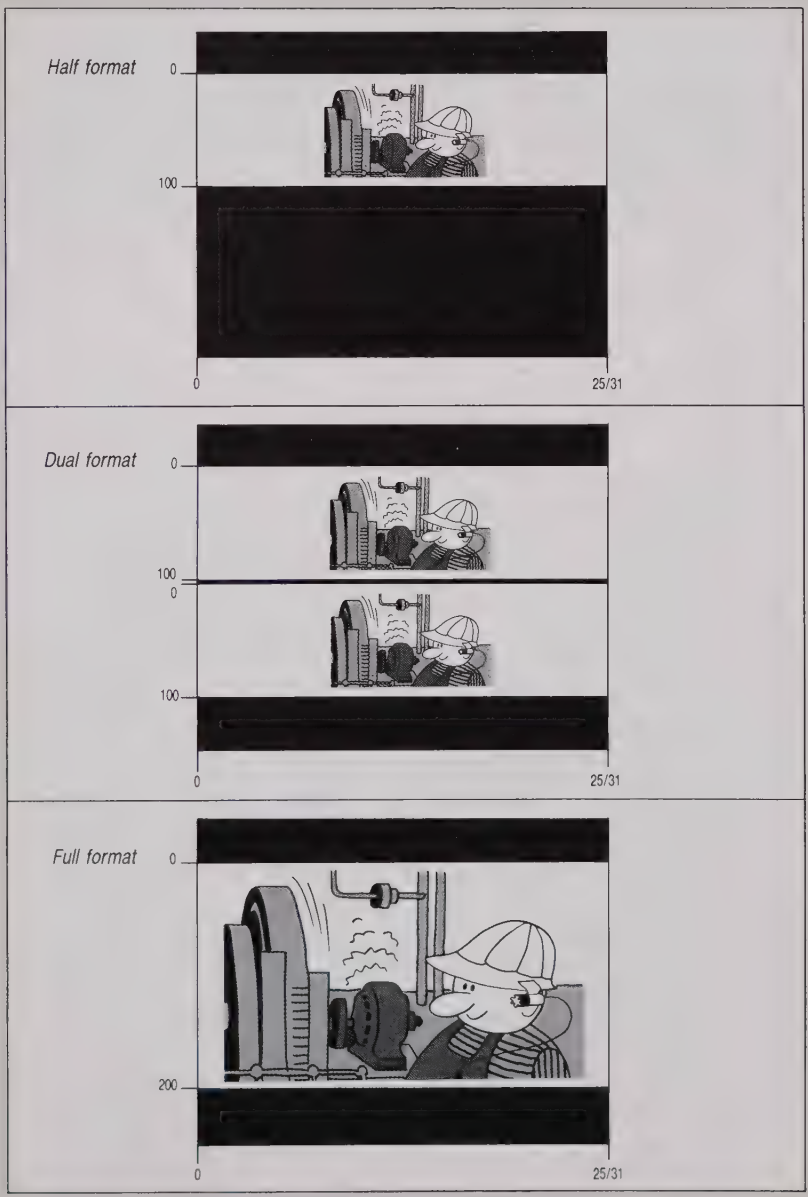
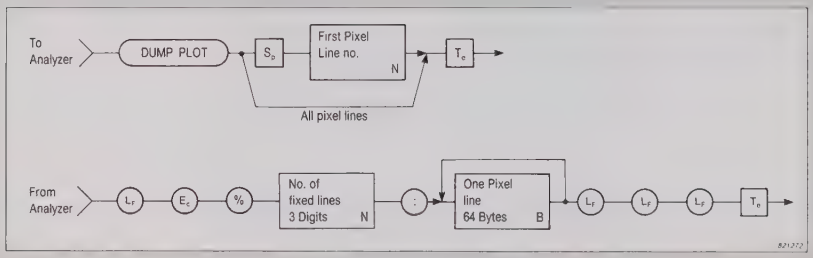


Fig. 3.10. Range of pixel coordinates

3.22. DUMP_ PLOT

Normally used to dump the screen picture to a graphics printer. The output from the 2032 is a binary representation of the raster screen information. The raster picture is made up of 290 lines each 512 dots wide, (that is, 64 bytes/line).The total number of bytes transferred is 18570.



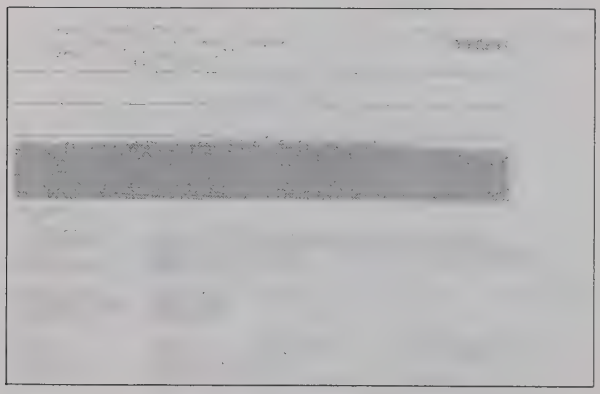
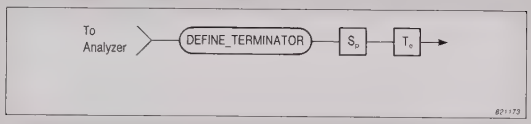


Fig. 3.11. Plot from the Graphics recorder Type 2313 using "DUMP_ PLOT"

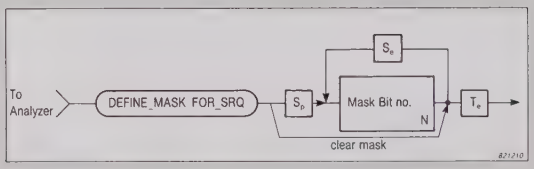
3.23. DEFINE_ TERMINATOR

Used to set the 2032 interface terminator to the desired value. Most computers require Line Feed (decimal 10) as a terminator, but other values are also used. Note that after SYSTEM RESET 9 the terminator is automatically set to ETX, (decimal 3).



3.24. DEFINE_MASK_FOR_SRQ

Under certain conditions, the 2032 has the capability of setting the SRQ interface line. However, in order to enable this, the corresponding bits of the SRQ mask must be set, (see Table 3.10). The mask is stored in continuous memory, (that is, it is unchanged by power off).If the JOB header is sent without succeeding parameters, all service requests are disabled.



Bit No.	Status Message	Condition for Bit to be Reset	Notes
DIO 1	Specified No. of averages has been reached	Requested Service and Polled	Use Job CURRENT_STATUS, AVERAGING_ NUMBER when current number of averages is required
DIO 2	Manual interface reset or self-test finished	Requested Service and Polled	DIGITAL I/O "Stop" or SYSTEM RESET pressed, change of ADDRESS switch or self test finished
DIO 3	Self-Test finished	Requested Service and Polled	May be used as a power on message as the Service Request Mask is saved in the continuous memory
DIO 4	Analogue Input Over-load has occurred in Ch. A and/or Ch. B	Requested Service and Polled	Use Job CURRENT_STATUS, INPUT_OVERLOAD when only status is required
DIO 5	Busy processing a Digital I/O Job	Ready for a new Digital I/O Job	SRQ activated and status bit 5 false when ready for new JOB
DIO 6	Digital I/O Error	Error State Removed	Error State cleared when Requested Service and Polled
DIO 7	Requested Service (RQS)	When Polled	This RQS bit is set by the Analyzer simul-taneously with the uni-line message SRQ
DIO 8	Pushbutton has been manually depressed since last readout using KEY_PUSH or KEY_BINARY_PUSH	Readout using KEY_PUSH, or KEY_BINARY-_PUSH	Senses key depressed regardless of Remote/Local State

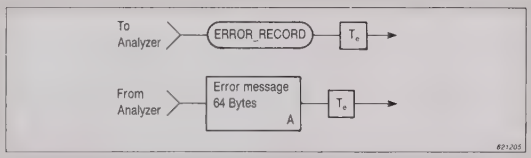
Table 3.10. Serial poll status messages and SRQ mask

3.25. ERROR_ RECORD

Used to read the last interface error message displayed by the 2032. Although the error conditions can be cleared by using Device Clear, Selected Device Clear, or Serial Poll, the error record is only reset to error # 0, (no errors), by one of the following conditions:

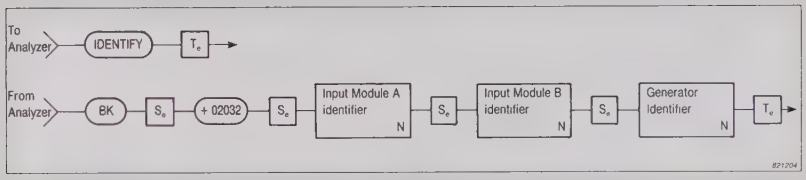
1. Power On
2. Manual SYSTEM RESET
3. Manual DIGITAL I/O "Stop"
4. JOB "SYSTEM_ RESET" with index
5. Read-out of the ERROR RECORD

The error messages are listed in section 4.1.



3.26. IDENTIFY

Used to read-out information about the analyzer type number and the installed hardware.



3.27. CONTROL_ PROCESS

Used to control the internal program execution of the 2032 and to give access to the more advanced functions. The JOB parameters are listed in Table 3.11. For a complete description, refer to the 2032 main Interface Manual.

	CP Parameter	Parameter Code
Graphic:	LOCK_DEVICE	LD
	UNLOCK_DEVICE	UD
	CLEAR_BACKGROUND_UNCONDITIONALLY	CB *
	DISPLAY_MODE_FOR_GRAPH	DM
	FLIP_GRAPH_CLEAR_BACKGROUND	FG *
	PROTECT_GRAPH_BACKGROUND	PG *
	UNPROTECT_GRAPH_BACKGROUND	UG *
	SET_BACKGROUND_FOR_GRAPH	SB *
Text:	NORMAL_VIDEO	NV *
	INVERSE_VIDEO	IV *
	NORMAL_FLASHING_VIDEO	NF *
	INVERSE_FLASHING_VIDEO	IF *
	ASCII_CHARACTER_TRANSFER	AC
	UNPACKED_ASCII_CHARACTER_TRANSFER	UA
Operating:	MAXIMUM_INTERFACE_ACTIVITY	MI *
	NORMAL_INTERFACE_ACTIVITY	NI *
	NEW_PROCESSOR_SPECIFICATION	NP *
	RESET_ALL_OPERATIVE_SEMAPHORES	RA *
	DEFINE_GRAPH_BASE_DATA	DG *
	COMPLETE_GRAPHS	CG *
	NEW_GRAPHS	NG *
Semaphore:	READ_OTHER_SEMAPHORE	RO
	SET_SEMAPHORE_FOR_REMOTE	SS
	RESET_SEMAPHORE_FOR_REMOTE	RS
Miscella-neous:	SINE_GENERATOR_FREQUENCY	SG
	UPPER_LOWER_BLOCK_TRANSFER	UL
	TIME_DELAY_IN_MILLISECONDS	TD
	SHORT_DELAY_FOR_SETTLING	SD *
	VERY_SHORT_DELAY_FOR_SETTLING	VS *
	NORMAL_DELAY_FOR_SETTLING	ND *
	SHADOW_HANDSHAKE_AT_ERROR_IO	SH *
	LED_PLOT	LP *
	LED_OUTPUT	LO *
	NEGLECT_MANUEL_INPUT_OUTPUT	NM *

* Only parameter code necessary

Table 3.11. CONTROL_ PROCESS parameters

3.28. SIGNAL_ PROCESS_ PROGRAM

Used to alter the execution of the internal program in the 2032 and to define new programs.

A description of this JOB can be found in the separate litterature.

3.29. BLOCK_ASCII_TRANSFER
BLOCK_BINARY_TRANSFER
BLOCK_SPLIT_TRANSFER
BLOCK_LOGICAL_TRANSFER

Used to directly transfer data to or from the 2032 main memory. These JOBs are only used in those rare situations where none of the previously described methods apply. A description of these JOBs can be found in the 2032 main Interface Manual.

4. APPENDIX

4.1. ERROR MESSAGES

When incorrect or invalid data is sent to the 2032 an error message is displayed in the bottom line of the display screen of the 2032.
The complete list of error messages is given in the following sections.

4.1.1. Basic communication

01 No listeners active
02 JOB specification incomplete

4.1.2. Integer Data

10 Integer negative. Allowed range: 0—32767 or subrange
11 Numeric data expected
12 Integer out of range. Allowed range: —32768—32767 or subrange
13 Integer out of range. Allowed range: 0—65535 or subrange
14 Integer value not allowed
15 Integer value too small
16 Integer value too big
17 Integer value zero. Allowed range: 1—32767 or subrange

4.1.3. Extended numeric data

20 No characters in input value. Numeric value missing
21 Too many characters in numeric value. Max 22

4.1.4. JOB parameters

40 Non excistent KP and KB keycode
41 Keycode not allowed in current mode
44 Setup field not selectable
45 Setup field setting cannot be sensed

4.1.5. Separators and terminator

51 Separator expected. Terminator received
53 Terminator expected. Separator received
54 Terminator expected
55 Quotation mark expected
56 Separator or Terminator expected
57 Invalid Terminator
58 Too many characters in text

4.1.6. Mnemonics

60 Undefined Parameter mnemonic
61 Undefined JOB mnemonic
62 Incorrect mnemonic. Non alpha character received

4.1.7. Data Dependent Conditions

80 No valid measured data

4.1.8. Setting Dependent Conditons

92 JOB condition not fulfilled
94 Flashing field in display setup
95 Equalized graph not allowed
97 Graph area not locked

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